PUBLICATION No. PM 1016

DATE November 1956

COPY No.

SECRET

SARAH

SEARCH EQUIPMENT

PROVISIONAL

MAINTENANCE INSTRUCTIONS

(TRANSMITTER-RECEIVER TYPE BR1082)

ULTRA ELECTRIC LIMITED

LONDON, W.3 ENGLAND

SARAH SEARCH EQUIPMENT

Amendment No. 1

to

Ultra Manual Ref. PM1016

PROVISIONAL MAINTENANCE INSTRUCTIONS

Transmitter-Receiver Units Type R425 & R625

The above manual covers Transmitter-Receiver Unit Type R825, comprising Transmitter-Receiver Type BR1082 (243 Mc/s), Power Unit Type BP105 and Visor Type BR1081-5.

This Amendment provides information on test frequencies and type numbers for Transmitter-Receiver Units Type R425 and R625, which operate on frequencies of 235 Mc/s and 213.5 Mc/s respectively. The data given in the following tables should be substituted for the corresponding data relating to Type R825 in the manual.

1. EQUIVALENT FREQUENCIES

Test Frequencies, Mc/s		
Type R825	Type R425	Type R625
243	235	213.5
241	233	211.5
242	234	212.5
244	236	214.5
245	237	215.5

NOTE:- In Fig. 3, Signal Generator coverage should be 200 to 250 Mc/s.

2. EQUIVALENT TYPE NUMBERS

Description	Type No.	
Transmitter-Receiver Unit	R425	R625
consisting of:		

Transmitter-Receiver	BR1042..BR1062
Power Unit	BP105..BP105
Visor	BR1081-5..BR1081-5
Sub-assemblies of	
Transmitter-Receiver	BR1042..BR1062
* Chassis Assembly	BR1042-1..BR1062-1
Transmitter Unit	BR1042-7..BR1062-7
RF/IF Unit	BR1042-30..BR1062-30

All other sub-assemblies are identical with the corresponding sub-assemblies of Transmitter-Receiver Type BR1082.

* NOTE:- The Chassis Assembly, which carries the main label for the Transmitter-Receiver, differs from BR1082-1 in Type No. only.

SARAH SEARCH TRANSMITTER-RECEIVER TYPE BR1082

PROVISIONAL MAINTENANCE INSTRUCTIONS

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INTRODUCTION & GENERAL NOTES

The term "second-line servicing" used in this manual may be interpreted thus, in relation to the SARAH Transmitter-Receiver Unit:-

Maintenance of the equipment to normal operational standards by (a) renewal of defective sub-assemblies and (b) application of the appropriate tests and adjustments necessitated by such renewal.

At "first-line servicing" level the Transmitter-Receiver Unit would merely be renewed as a complete assembly.

To ease the problems of second-line servicing, each section of the Unit has been designed as a complete sub-assembly which is separately removable from the main Chassis Assembly. It is nevertheless important to remember that faults are sometimes created during servicing processes and great care should be taken when removing and fitting sub-assemblies. In particular, the notes marked CAUTION in the following chapters should be strictly observed.

WARNING: SINCE VOLTAGES OF UP TO 1500V ARE PRESENT IN THE UNIT, GREAT CARE SHOULD ALSO BE TAKEN WHEN HANDLING THE UNIT WITH THE SIDE-PANELS REMOVED.

A complete schedule of the sub-assemblies comprising the Transmitter-Receiver Unit Type R825 (which consists of Transmitter-Receiver Type BR1082 and Power Unit Type BP105) appears in Appendix 1 to this manual.

NOTE: The references in Appendix 1, and all information on tuning procedures, etc., apply only to a Unit operating on the distress frequency, i.e., 243 Mc/s + 2 Mc/s approximately. To cater for Units operating on other frequencies within the band 200 to 250 Mc/s, an amendment sheet covering the differences in sub-assembly references and test procedures will be included in the manual.

Sub-assemblies as supplied by the manufacturer are tested before dispatch

against a standard Transmitter-Receiver and should require little, if any, adjustment. Permissible power supply tolerances may, however, necessitate some alignment procedure and this is best confirmed by tests on the complete Transmitter-Receiver when a new sub-assembly has been fitted.

NOTE: The information given in Chapter 2 (TESTS & ADJUSTMENTS) is intended for the guidance of users in general. Where special arrangements have been made with particular users involving specific test equipment, Chapter 2 should be disregarded and reference made to the instructions issued by the appropriate authority.

The following special notes on particular sub-assemblies should be carefully read:-

(a) Power Unit Type BP105

The Power Unit should never be switched on unless it is fully loaded by the complete Transmitter-Receiver, with all sub-assemblies connected, or by the Power Unit Voltage Tester Type QT179. Failure to observe this precaution may cause capacitor or transformer breakdown, the off-load voltages being much higher than the working voltages.

(b) Transmitter Unit Type BR1081-7

Particular care should be taken when fitting, or refitting, a Transmitter Unit sub-assembly, to ensure that the tuning control driving dog is correctly aligned with respect to the quadrant gear on the Transmitter Unit. Incorrect alignment can result, in the worst case, in fracture of the RF tuning coil slugs.

(c) Timebase Unit Type BR1081-12

This unit determines the synchronising of the incoming SARAH Beacon pulses to the CRT timebase, therefore the setting-up instructions in Chapter 2 should be carefully followed. The setting-up of timebase duration

should be given particular attention to ensure that signals from all beacons, irrespective of their coding, will be visible on the CRT trace. For example, if too much suppression is applied, an "A"-coded beacon signal may not appear on the trace. Similarly, if the timebase duration is too short a "D"-coded beacon signal may be missed.

(d) RF/IF Unit Type BR1082-30

It is emphasised that in the RF/IF Unit the manual tuning and automatic tuning are interrelated. Automatic tuning always takes place about the frequency selected on the manual TUNE RX control. The manual control must therefore be set to the correct mid-frequency, as detailed in Chapter 2, Section 3, before the function switch is turned to the SEARCH position.

Chapter 1

DISMANTLING & REASSEMBLY

The spares listed in Appendix 1 are recommended to meet second-line servicing requirements.

The instructions given in this Chapter cover separation of the Transmitter-Receiver Unit into its major sub-assemblies, and subsequent reassembly.

1. SEPARATING THE POWER UNIT FROM THE TRANSMITTER-RECEIVER

   (a) Withdraw the six 2 BA screws securing the Power Unit faceplate to the casing.

   CAUTION:- DO NOT ATTEMPT TO REMOVE THE POWER UNIT WITHOUT USING THE EXTRACTOR TOOL PROVIDED. SCREW-DRIVERS OR LEVERS ARE CERTAIN TO DAMAGE THE NEOPRENE SEALING GASKET.

   (b) Fit the extractor tool by placing the main plate over the Plessey plug and socket and screwing on the dust covers.

   (c) Pull the extractor tool handle down and draw the Power Unit firmly away from the Transmitter-Receiver.

   (d) The Power Unit casing may now be removed, if desired, by undoing the four 2BA countersunk screws securing it to the rear of the Transmitter-Receiver casing.

2. REASSEMBLING THE POWER UNIT TO THE TRANSMITTER-RECEIVER

   (a) Refit the Power Unit casing (if removed) by inserting and tightening the four 2BA countersunk screws securing it to the rear of the Transmitter-Receiver casing. Lock with suitable varnish.

   (b) Ensure that the strips of insulating sheeting are in position inside the Power Unit casing.

(c) Push the Power Unit gently home, taking care to see that the locating dowels, if fitted, are aligned with their holes or slots on the 18-way socket.

(d) Secure by tightening the six 2BA fixing screws. Lock with varnish.

3. REMOVAL OF SIDE-PANELS

NOTE: Renewal of a defective sub-unit of either side-panel is most conveniently carried out by renewing the appropriate panel complete, as described below.

CAUTION:- NEVER PULL ON CONNECTING WIRES TO DISENGAGE SOCKETS OR DAMAGE WILL CERTAINLY RESULT. USE THE LOOPS PROVIDED.

(a) Right-hand Side-panel

The RF/IF Unit is attached to the Right-hand Side-panel, which should be removed as follows:-

(i) Unscrew and withdraw the six cheesehead screws securing the Side-panel to the main casting. Ease the Side-panel off, taking care not to damage the neoprene sealing. DO NOT use blades or levers.

(ii) Disconnect plug PL201 connecting the Unit to the Chassis Assembly. Unscrew the retaining ring of the cable-mounted coaxial socket on the RF input lead and disconnect the socket from the plug on the Unit.

(b) Left-hand Side-panel

The Timebase Unit is attached to the left-hand side-panel, which should be removed as follows:-

(i) Unscrew and withdraw the six cheesehead screws securing the side-panel to the main casting. Ease the side-panel off, taking care not to damage the neoprene sealing. DO NOT use blades or levers.

(ii) Disconnect the plug connecting the unit to the socket on the Chassis Assembly.

4. REMOVAL OF INDIVIDUAL UNITS

The individual units should be removed as follows:-

(a) RF/IF Unit

(i) Remove the Right-hand Side-panel as detailed above.

(ii) Unscrew and withdraw the three special 2BA retaining screws securing the Unit to the Side-panel.

(iii) Withdraw the Unit in a direction at right-angles to the Side-panel.

(b) Timebase Unit

(i) Remove the Left-hand Side-panel as described above.

(ii) Unscrew and remove the two special 2BA retaining screws securing the Timebase Unit to the side-panel and withdraw the Unit.

(c) Transmitter Unit

(i) Remove the Left-hand Side-panel as described above.

(ii) Withdraw PL401, the twelve-way plug, from its socket on the Chassis Assembly and remove the aerial coaxial plug from the top rear of the main casting.

(iii) Loosen the 4BA hexagonal-headed fixing bolts securing the Transmitter Unit to the casting, using an angled 4BA flat spanner of width not exceeding 7/16 in. across the outside of the jaws.

(iv) Turn the Transmitter-Receiver Unit upside down and swing the rear end of the Transmitter Unit gently outwards until the inner rear corner is just clear of the bolt.

(v) Draw the Transmitter Unit towards the rear of the casting until the driving dog is free and the front fixing bolt clear of the fixing lug.

(vi) Withdraw the unit sideways.

(d) Cathode-ray Tube

CAUTION:- HANDLE THE TUBE VERY CAREFULLY DURING THIS

OPERATION, TO AVOID RISK OF DAMAGE TO THE TUBE AND SOCKET CONNECTIONS. DO NOT ALTER THE POSITION OF THE RING MAGNETS, IF FITTED.

(i) Unscrew the two spring-loaded 4BA retaining screws and remove the CRT clamp. Withdraw the socket from the tube.

(ii) Disconnect the post-deflection accelerator lead.

(iii) Gently rotate the tube until the open ends of the shield are accessible. Contract the shield by pressing upon it with the fingers until it clears the centre fixing lug on the main casting and move the tube and shield carefully backwards to clear the front cushion ring. Withdraw the tube from the Chassis Assembly.

5. REASSEMBLY OF INDIVIDUAL UNITS

(a) RF/IF Unit

Place the Unit on the locating pillars on the Right-hand Side-panel. Refit the special 2BA fixing screws and lock with varnish.

(b) Timebase Unit

Secure the Timebase Unit to the Left-hand Side-panel with the two 2BA special screws. Lock with suitable varnish.

(c) Transmitter Unit

(i) Verify that the TUNE TX knob on the front panel is in the fully counter-clockwise position, so that the slot in the driving dog points at "five minutes to five".

(ii) Move the quadrant gear on the Transmitter Unit into full mesh, so that it is down against the fixing lug and the pin in the collar is at "five minutes past seven".

(iii) Turn the Transmitter-Receiver Unit upside down and slide the front (straight) fixing lug between the spacing washer and main casting, at the same time inserting the driving dog on the flexible shaft into the collar on the Transmitter Unit.

(iv) Verify that the TUNE TX knob can be moved through approximately 330°, thus turning the quadrant shaft through nearly 90° in its usual arc.

(v) Swing the Transmitter Unit inwards until the bolt enters the fixing slot. The spacer will now fall into the depression provided.

(vi) Tighten both fixing bolts and lock with varnish

(vii) Reconnect plug PL401. Reinsert the TX AERIAL coaxial plug and screw home the retaining nut.

(d) Cathode-ray Tube

(i) Position the shield so that the open ends are accessible and push the tube gently back into place, pressing the shield sufficiently to clear the centre fixing lug on the main casting. Ease the tube forward until the front end enters the rubber cushion ring and is as close as possible to the graticule.

(ii) Reinsert the tube base into the socket. Take care not to move the Ring Magnets or Seating Ring, if fitted.

(iii) Carry out the adjustment detailed in Chapter 2, Section 8.

(iv) Reconnect the post-deflection accelerator lead.

(v) Refit the clamp and insert the two spring-loaded 4BA retaining screws.

6. REASSEMBLY OF SIDE-PANELS

(a) Right-hand Side-panel

(i) Reinsert plug PL201 into its socket and reconnect the coaxial socket to the plug on the RF/IF Unit.

(ii) Refit the Side-panel, ensuring that no leads are trapped. Loop the coaxial lead around the post-deflection accelerator terminal. Secure with the six 2BA screws.

(b) Left-hand Side-panel

Ensure that the insulating sheet opposite S502 is in position, reinsert PL301 and refit the Side-panel. The Timebase Unit cable should be

placed over the relay housing and under the CRT clamp retaining screws. Secure the panel with the six 2BA screws.

Chapter 2

TESTS & ADJUSTMENTS

When a sub-assembly of the Transmitter-Receiver Unit has been renewed, or removed for any reason, and refitted, appropriate tests should be applied to the complete Transmitter-Receiver as detailed in the relevant section of this chapter, and any necessary adjustments made. Each section covers the procedure applicable to one particular sub-assembly.

A simple test rig for this purpose is shown diagrammatically in Fig. 3 and the following list of test equipment is recommended as a minimum:-

1. EQUIPMENT REQUIRED

(a) UHF Signal Generator, frequency coverage to include the range 200 to 250 Mc/s, with attenuation down to 1μV. (E.g., Marconi Signal Generator Type TF801A, Signal Generator Type 53 ref. 10SB/189, or Signal Generator Type TS-497A/URR).

(b) Pulse Generator of p.r.f. 10 kc/s, pulse width 7μs approximately.

(c) Indicator Electrical ref. 10Q/92.

(d) Cathode-ray Oscilloscope.

(e) Two SARAH Beacon Assemblies, one with Coding A (colour coded red), one with Coding D (colour coded green).

(f) Wavemeter, frequency coverage 200 to 250 Mc/s.

(g) Stop Watch.

* (h) Power cable, 6-way (e.g., sextometvin), fitted at one end with a Plessey Mk IV 6-way free socket, the opposite end being terminated in flying leads of suitable length for connection to power supplies.

* (j) Audio cable, 6-way (e.g., sextometvin), fitted at one end with a Plessey Mk IV free plug and at the opposite end with suitable jacks for connection to the microphone and telephones of the headset.

(k) Headset, Tels. and Mic.

Telephone impedance: 100 to 200Ω

** Microphone impedance: 100 to 200Ω

(m) Three SRIC Sockets, ref. ZA540155.

(n) One plug ref. ZA540151 or ZA540152.

(p) RF cable, 52Ω, (e.g., Uniradio 43), length approximately 3 ft.

(q) Resistor, 1 MΩ.

(r) Two resistors, 100 kΩ.

(s) Accumulator or dry cell (2 to 6V).

NOTES:

* If Junction Box Type TJ211 is fitted, cables (h) and (j) should be replaced by Connectors ref. CP1240 and CR1225 respectively. These are normally supplied with installations which incorporate the Junction Box. A connector suitable for connection to the American-type Receptacle ref. AN-3102A-14S-2P on the Junction Box should also be provided. See Fig. 3A.

** This does not apply when the Junction Box is fitted, since carbon microphones are then used.

SPECIAL NOTE: Some inconvenience is caused by the aerial switching action during certain adjustments to the Transmitter-Receiver, when a test signal is injected via the port aerial plug only, as specified in the following tests. To overcome this, a special Matching Pad (Type No. to be issued later) is available which converts the single output from the signal generator into two identical outputs which are injected via the port and starboard plugs respectively. For Timebase Unit tests only, since no absolute RF sensitivity figures are required, a dual output can be obtained by connecting a second SRIC socket, in parallel with the existing socket, to the starboard aerial plug.

2. PRELIMINARY INSTRUCTIONS

Interconnect the Transmitter-Receiver Unit and Test Equipment as illustrated in Fig. 3 and make connections as shown to the power and audio sockets at the rear of the Power Unit Type BP105. If the Junction Box Type TJ211 is fitted, connect as shown in Fig. 3A.

The tests and adjustments required will depend upon the particular sub-assembly which has been renewed or refitted. For the relevant procedure, refer to the instructions given under the appropriate section heading below.

3. CHASSIS ASSEMBLY TYPE BR1082-1

When a complete Chassis Assembly has been renewed, tests should be carried out on the associated RF/IF Unit, the Timebase Unit and the Transmitter Unit as detailed below. Adjustment of the CRT Assembly will also be required after refitting (see Section 7).

Since the Aerial Switching and automatic tuning circuits are contained in the Chassis Assembly, the timing of the Aerial Switching should be adjusted and the receiver tuning tested, in accordance with the following procedure. All sub-assemblies must be connected before the mains supply to the Transmitter-Receiver Unit is switched on.

(a) Aerial Switching

The test circuit shown in Fig. 4 is required for adjustment of the Aerial Switching rates.

(i) Turn the SEARCH/HOME switch of the Transmitter-Receiver to the HOME position and the function switch to the RX B position.

(ii) The six preset controls mounted at the right-hand side of the Chassis Assembly are identified on a transfer located on the inner surface of the Right-hand Side-panel. Adjust the HOMING control (RV152) to obtain unity mark/space ratio of the waveform shown on the oscilloscope (30 to 80 milliseconds each side).

(iii) Turn the SEARCH/HOME switch to the SLOW position.

(iv) Turn the function switch to the XTAL CHECK position and adjust the GAIN control so that the amplitude of the crystal-controlled pulses is at a convenient level.

(v) If necessary, adjust the SLOW OFF (RV151) and SLOW ON (RV153) controls so that each aerial is connected for a period 5 ± 0.2 seconds in turn, as shown by the pulse display appearing at the left and right-hand side of the vertical trace alternately. A stop-watch should be used to measure the time intervals.

(vi) Turn the SEARCH/HOME switch to FAST and verify that each aerial is now connected for a period of 0.3 to 0.8 sec in turn.

NOTE: No independent adjustment is provided for FAST switching.

(b) Receiver Tuning

Switch on the Signal Generator (connected to the port aerial plug on the Transmitter-Receiver) and Pulse Generator. Adjust the Signal Generator and apply a modulation pulse of width 7μs and p. r. f. 10 kc/s from the Pulse Generator, in accordance with the instructions supplied by the makers of these instruments.

Adjust the Signal Generator frequency to 243 Mc/s and the output level to approximately 20μV. Apply the following adjustments and tests to the Chassis Assembly:-

(i) Turn the SEARCH/HOME switch to the SLOW position.

(ii) Set the TUNE RX control to its midway position and adjust the GAIN control to a convenient level. The signal should consist of three pulses, plus the initiating pulse at the extreme top of the trace.

(iii) If necessary adjust the MANUAL PRESET (RV156) control for maximum signal amplitude on the Transmitter-Receiver CRT screen, readjusting the GAIN control as required to maintain a convenient signal level.

(iv) Adjust the Signal Generator frequency to 241 Mc/s and verify that it is possible to tune to this frequency by adjustment of the TUNE RX control near the low frequency end of its travel.

NOTE: The TUNE RX control may actually cover a range greater than 241 to 245 Mc/s, thus it may not be necessary to set the control to the extreme end of its travel.

(v) Adjust the Signal Generator frequency to 245 Mc/s and repeat the test given in paragraph (iv) with the TUNE RX control set to the high-frequency end of its travel.

(vi) Measure and record the anode voltages of V153 (see Fig. 5) corresponding to frequencies of 241 Mc/s and 245 Mc/s respectively, as established by manually tuning the receiver to the Signal Generator at these frequencies.

(vii) Adjust the Signal Generator frequency to 243 Mc/s and readjust the TUNE RX control for maximum signal amplitude.

(viii) Turn the SEARCH/HOME switch to the SEARCH position. The anode voltage of V153 will now vary cyclically, in synchronism with the aerial switching, between an upper and a lower limit. Measure this voltage and record the extreme upper and lower values observed during the excursion. These values should correspond with the voltages measured in paragraph (vi) above.

(ix) If the voltage limits are incorrect, adjust the SEARCH CENTRE preset control (RV154) and SEARCH WIDTH preset control (RV157) on the Chassis Assembly (these are identified on the transfer on the Right-hand Side-panel) to obtain the required voltage sweep.

4. RIGHT-HAND SIDE-PANEL ASSEMBLY TYPE BR1082-16

Tests after fitting a Right-hand Side-panel Assembly are required to determine:-

(a) RF Sensitivity

It is necessary to verify that the receiver tunes over the correct frequency band on both manual and automatic tuning, since the characteristics of the magnetic reactor (TR252) vary from one RF/IF Unit to another.

Two methods of test are given in this section. The first method provides a rapid, approximate test for verification of the general performance standard. Following this, a detailed analytical test is appended for units which fail the first test, or on which further data is required.

(a) RF Sensitivity - Approximate Test

(i) Switch on the power supply to the Transmitter-Receiver Unit and allow two minutes for the Unit to stabilise.

(ii) With no signal input to the Transmitter-Receiver, turn the function switch to the RX B position.

(iii) Turn the SEARCH/HOME switch to the SLOW position.

(iv) Turn the GAIN control clockwise and verify that a normal amount of "grass" appears on the CRT screen.

(v) Adjust the GAIN control so that "grass" just appears on the trace, slowly rotate the TUNE RX control and verify that the "grass" varies slightly as the receiver is manually tuned.

(b) RF Tuning - Approximate Test

(i) Turn the function switch to the XTAL CHECK position and the SEARCH/HOME switch to the SLOW position.

(ii) Adjust the GAIN control to a convenient level and the TUNE RX control for maximum signal amplitude, readjusting the GAIN control as required.

(iii) The TUNE RX control should now be near its midway position. If the control is off centre, adjust the oscillator frequency by turning the tuning slug of L256 (see Fig. 2) in the required direction until maximum signal is obtained with the TUNE RX control centred. See Chapter 1 Section 3 (a) for method of removing R. H. Side-panel Cover.

(c) RF Sensitivity - Analytical Test

(i) Turn the function switch of the Transmitter-Receiver to the RX B position and the SEARCH/ HOME switch to the SLOW position.

(ii) Adjust the Signal Generator frequency to 243 Mc/s, and the carrier level to approximately 20μV.

(iii) Adjust the TUNE RX control on the Transmitter-Receiver for maximum signal amplitude. Adjust the GAIN control to a convenient level.

(iv) Reduce the Signal Generator output until the signal pulse amplitude is twice that of the "grass" on the CRT trace. Note the input required from the Signal Generator for this output level.

NOTE: The GAIN control setting for this test should be such that "grass" just appears on the trace.

(v) Repeat the procedure in paragraphs (iv) and (v) with the Signal Generator frequency adjusted to 242 Mc/s and 244 Mc/s respectively.

(vi) The following sensitivity figures should be obtained at these frequencies:-

243 Mc/s : input not greater than 6.3μV
242 Mc/s : " " " " 9μV
244 Mc/s : " " " " 9μV

(vii) Transfer the Signal Generator connection from the port aerial plug of the Transmitter-Receiver to the starboard aerial plug and repeat the tests for RF Sensitivity given in paragraph (c) above. Sensitivity figures should be within 1 dB of those obtained in paragraphs (c) (iv) and (v).

NOTE: Some allowance has been made in the sensitivity figures for the degree of mismatch which may occur between the output impedence of the signal generator and the input impedance of the SARAH receiver (nominally 52Ω). In practice, the figures quoted should be met with

signal generators designed to match into loads of any impedance between 30Ω and 70Ω.

(d) Frequency Coverage - Manual - Approximate Test

(i) Adjust the Signal Generator frequency to 241 Mc/s.

(ii) Adjust the TUNE RX control on the Transmitter-Receiver for maximum signal on the CRT. The signal pulses should show no visible distortion.

(iii) Repeat this procedure with the Signal Generator frequency adjusted to 245 Mc/s.

(e) Frequency Coverage - Automatic - Approximate Test

(i) Set the TUNE RX control to its midway position, corresponding to a frequency of 243 Mc/s.

(ii) Turn the SEARCH/HOME switch to the SEARCH position.

(iii) Adjust the Signal Generator frequency to 241 Mc/s.

(iv) Verify that the pulse signal just reaches peak amplitude and is then switched to the opposite side at a rate of approximately twelve times per minute. Slightly vary the setting of the Signal Generator frequency control to ensure that the peak signal is actually reached at 241 Mc/s.

(v) Repeat the above procedure with the Signal Generator frequency adjusted to 245 Mc/s.

If the Transmitter-Receiver Unit fails to meet these tests, remove the Right-hand Side-panel as detailed in Chapter 1, leaving the RF and power cables connected, and readjust the RF Tuning as detailed below.

(f) Adjustment of RF Tuning - Analytical Test

(i) Adjust the Signal Generator frequency to 243 Mc/s at a carrier level of between 10 and 20μV pulse-modulated by 7μs pulses at 10 kc/s p.r.f.

(ii) Turn the function switch to the RX B position and the SEARCH/HOME switch to SLOW.

(iii) The display should take the form of three pulses, plus an initiating

pulse at the extreme top of the trace. Adjust the GAIN control to a convenient level and the TUNE RX control for maximum signal amplitude.

(iv) The TUNE RX control should now be in its midway position. If the control is off centre, adjust the oscillator frequency by turning the tuning slug of L256 (see Fig. 2) in the required direction until maximum signal is obtained with the TUNE RX control centred.

(v) Adjust the Signal Generator signal to 241 Mc/s, tune the receiver for maximum signal and measure the anode voltage of V153 (see Fig. 5). (This voltage will be approximately 110V, but will vary considerably from one unit to another.)

(vi) Adjust the Signal Generator frequency to 245 Mc/s, tune the receiver for maximum signal and measure the anode voltage of V153. (This will be approximately 60V.)

(vii) Adjust the Signal Generator frequency to 243 Mc/s and the TUNE RX control for maximum signal.

(viii) Turn the SEARCH/HOME switch to SEARCH. The anode voltage of V153 will now vary cyclically, in synchronism with the aerial switching, between an upper and a lower limit. Measure this voltage and record the extreme upper and lower values observed during the excursion. These values should correspond with the voltages measured in paragraphs (v) and (vi) above.

(ix) If the voltage limits are incorrect, adjust the SEARCH WIDTH preset control (RV157) on the Chassis Assembly (these are identified on the transfer on the Right-hand Side-panel) to obtain the required voltage sweep.

4. <u>TIMEBASE UNIT TYPE BR1081-12</u>

Two methods of test after renewing or refitting a Timebase Unit

are given in this section. The first is a rapid, approximate method using two Beacon Assemblies, one coded A and the other coded D.

Following this is a more detailed analysis, with instructions for adjustment of the TRIGGER and CODING controls and, finally, a complete setting-up procedure for the timebase.

(a) Approximate Test

With the Test Rig connected as shown in Fig. 3 (and Fig. 3A if the Junction Box is fitted), carry out the following test procedure:-

(i) Place the two Beacon Assemblies a short distance from the Transmitter-Receiver, erect the Beacon aerials and pull the switch plungers forward.

(ii) Switch on the power supply to the Transmitter-Receiver Unit and allow two minutes for the Unit to stabilise.

(iii) Turn the function switch to the RX B position. Adjust the TUNE RX control for maximum signal amplitude, and the GAIN control to maintain the tips of the pulses at the outer vertical lines of the graticule.

(iv) Verify that the signal from the A-coded Beacon (colour-coded red) appears on the lowest quarter of the CRT trace and the signal from the D-coded Beacon on the uppermost quarter of the trace. Also verify that both pulses are firmly "locked", i. e., that they are stationary on the CRT trace.

(b) TRIGGER control

(i) Connect the Signal Generator output to the port aerial plug on the Transmitter-Receiver. Switch on the Signal Generator and Pulse Generator.

(ii) Adjust the Signal Generator frequency to 243 Mc/s and the Pulse Generator output accurately to a p. r. f. of 10 kc/s and 7μs pulse width.

(iii) Adjust the output of the Signal Generator to a convenient level.

(iv) Turn the SEARCH/HOME switch on the Transmitter-Receiver to the SLOW position. Adjust the TUNE RX control for maximum signal amplitude.

(v) Adjust the GAIN control to obtain a moderate amount of "grass" on the CRT trace. Reduce the Signal Generator output until the pulse amplitude is twice that of the "grass".

(vi) Under these conditions the pulses should be firmly locked. If the pulses appear to free run or slip, switch off the power supply to the Transmitter-Receiver and remove the Left-hand Side-panel as detailed in Chapter 1, leaving the multiway plug connected.

(vii) Switch on the power supply and turn the function switch to the TX B position. Turn the GAIN control fully counter-clockwise.

(viii) Adjust the preset control marked TRIG on the Timebase Unit so that the timebase just fails to free run.

(ix) Turn the function switch to RX B. Increase the gain until the Signal Generator pulses reappear above the "grass" and readjust the TUNE RX control for maximum signal.

(x) The pulses should now be fully locked. If there is still any sign of instability, readjust the TRIG control until satisfactory locking is obtained.

(xi) Switch off the power supply and refit the Side-panel.

(c) <u>Timebase Duration, Velocity and Suppression</u>

(i) Switch on the power supply to the Transmitter-Receiver.

(ii) Increase the Signal Generator output until the pulses reach the outer vertical lines of the graticule, with no "grass" visible on the trace. (Some adjustment of the GAIN control will be necessary to achieve this condition.)

(iii) Provided that the Pulse Generator has been accurately set to 10 kc/s at a pulse width of 7μs, a correctly-aligned timebase should show four pulses, including the first pulse at the extreme top of the CRT trace. The distribution of the pulses down the trace should correspond with Fig. 6. In addition, when the lowest pulse is placed midway between the central horizontal cursor lines by rotation of the SHIFT control, the pointer on the SHIFT control should be in line with the left-hand mark of the A sector on the CODING scale. Similarly, when the third pulse from the bottom of the trace is placed midway between the central horizontal cursor lines, the pointer should be in line with the right-hand mark of the D sector on the scale.

(iv) If there is an alignment error of approximately the same amount in the same direction at each of the above positions, remove the knob by unscrewing the coin-slotted insert and lifting off the knob body. Reposition the pointer in line with the correct mark and refit the knob. Verify the alignment at the opposite end of the pointer travel.

(v) If the pulse distribution does not conform with that shown in Fig. 6, switch off the power supply and remove the Left-hand Side-panel as detailed in Chapter 1. The timebase should now be set up as detailed in the following sub-section (d).

(d) Setting Up the Timebase

(i) Switch on the power supply to the Transmitter-Receiver Unit. Adjust the Signal Generator output (modulated by 7μs pulses at 10 kc/s p. r. f.) and Transmitter-Receiver GAIN control to obtain pulses on the CRT of sufficient amplitude to reach the outer vertical line on the port side of the trace, with no "grass" visible on the trace.

(ii) Turn the SUPP preset control on the Timebase Unit fully counter-clockwise (suppression completely removed).

(iii) Set the TB VEL preset and SCAN AMP preset to their mid-way positions.

(iv) Turn the SUPP preset slowly clockwise until the lowest pulse is dimmed out, then turn the control back sufficiently just to brighten up the lowest pulse.

(v) Adjust the SCAN AMP preset so that the clearance between the ends of the trace and the top and bottom of the CRT face respectively is approximately 1/8 in. when the screen is viewed directly, i.e., without the visor.

(vi) Adjust the TB VEL preset to obtain three pulses on the trace, not including the initiating pulse visible at the extreme top of the trace. The third pulse (counted from the bottom of the trace) should be approximately 1/8 in. from the initiating pulse at the top of the trace.

(vii) Adjust the SHIFT control on the front panel so that the bottom pulse is midway between the central horizontal cursor lines. The pointer of the SHIFT control should now be in line with the left-hand mark of the A sector of the CODING scale. If the pointer is out of alignment, reposition it as detailed in (c) (iv) above.

(viii) Adjust the SHIFT control to bring the third pulse from the bottom midway between the cursor lines. The pointer should now be in line with the right-hand mark of the D sector on the CODING scale. If the pointer is out of alignment, place it in line with the right-hand mark and adjust the VERT preset on the Timebase Unit so that the pulse is centred between the cursor lines.

(e) Speech Test

(i) Remove the Signal Generator connection from the port aerial plug on the Transmitter-Receiver and switch off the Signal Generator.

(ii) Turn the function switch to the RX B position.

(iii) Place a SARAH Beacon Assembly which is known to transmit satisfactory speech signals, near the Transmitter-Receiver. Erect the Beacon Aerial and pull the switch plunger forward.

(iv) Tune the receiver exactly to the Beacon frequency and turn the function switch to the RX R/T position. Verify that satisfactory speech reception is obtained in the Transmitter-Receiver headset when the TALK button on the Speech Unit is pressed and speech modulation is applied to the latter. Switch off the power supply to the Transmitter-Receiver and refit the Left-hand Side-panel.

5. TRANSMITTER UNIT TYPE BR1081-7

Tests after renewing or refitting a Transmitter Unit sub-assembly are required to determine:-

(a) Crystal Check Performance

(b) Transmitter Frequency and Beacon Output

(c) RF Output on Speech

(d) Performance on Speech

(e) Transmitter Tuning

(f) Frequency Coverage

This section describes a series of functional tests of the above items suitable for second-line servicing.

Make the Test Rig connections as shown in Fig. 3 (and 3A if the Junction Box is fitted), but disconnect the Signal Generator from the port

aerial plug, switch off the Signal Generator and connect Indicator Electrical ref. 10Q/92 to the Transmitter plug (coded white on the Transmitter-Receiver). The Indicator should remain connected for all Transmitter Unit tests.

(a) Crystal Check Performance

(i) Turn the function switch to the XTAL CHECK position.

(ii) Turn the SEARCH/HOME switch to the SEARCH position and tune the receiver, at the same time advancing the GAIN control. A series of pulses should now appear on the CRT trace.

(b) Transmitter Frequency and Beacon Output

(i) Turn the function switch to the TX B/TUNE TX position and adjust the TUNE TX control until an undistorted pulse is obtained on the CRT trace, adjusting the GAIN control as required to obtain a reasonable pulse amplitude on the CRT trace. (The TUNE RX control should be left in the position set during (a) above.)

(ii) Adjust the TUNE TX control for maximum pulse amplitude. The white line on the TUNE TX knob should now be in line with the calibration mark on the front panel. If the knob is out of alignment, remove it and realign it with the calibration mark.

(c) RF Output on Speech

(i) Turn the function switch to the TX R/T position. The indicator lamp should glow.

(ii) Apply speech modulation by speaking or whistling into the headset microphone. The Indicator lamp should now glow more brightly.

(d) Performance on Speech

The following functional test should be made in conjunction with a SARAH Beacon Assembly placed near the Transmitter-Receiver Unit:

(i) Erect the Beacon aerial and pull the switch plunger forward.

(ii) Turn the function switch on the Transmitter-Receiver to the TX R/T position if no Press to Talk facility is available. Otherwise, leave the function switch in the RX R/T position.

(iii) Speech modulation applied via the headset microphone should be clearly heard in the Speech Unit of the Beacon Assembly when the LISTEN button is pressed.

(iv) If necessary, carry out the Transmitter Tuning procedure detailed in (e) below.

(e) Transmitter Tuning

The following procedure should be adopted for tuning the Transmitter Unit accurately to the incoming beacon signal:-

(i) Switch on the test Beacon Transmitter.

(ii) Turn the function switch to the RX B position. Turn the SEARCH/HOME switch to the HOME position and, with the GAIN control set to a convenient level, adjust the TUNE RX control for maximum signal amplitude. Adjust the GAIN control so that the signal pulses just reach the outer vertical lines of the graticule.

(iii) Turn the function switch to the TX B/TUNE TX position and adjust the TUNE TX control for maximum signal amplitude, reducing the gain as required.

NOTE: A certain amount of deviation in the TUNE TX knob calibration is permissible when a Beacon is used for a functional test, since the Beacon frequency tolerance is ± 700 kc/s.

(f) Frequency Coverage

The Transmitter frequency range should be 241 to 245 Mc/s inclusive. The coverage can be verified by turning the function switch to the TX R/T position and measuring the Transmitter

frequency, at the extreme ends of the range, on a suitable wavemeter. The input circuit of the wavemeter should be closely coupled to Indicator Electrical ref. 10Q/92.

6. POWER UNIT TYPE BP105

When a Power Unit has been renewed or refitted, the overall performance of the Transmitter-Receiver should be verified as detailed in the appropriate sections above.

If a Power Unit Voltage Tester (Ultra Type QT179) is available, the Power Unit output voltages under load should be measured before assembly to the Transmitter-Receiver, as detailed in the instructions supplied with the Tester.

7. CATHODE-RAY TUBE ASSEMBLY TYPE X854-1000

(a) CRT Adjustment

When an existing CRT Assembly has been refitted, without removal or disturbance of the Ring Magnets and Seating Ring, or a new CRT has been fitted which does not require magnetic correction, the following adjustment will ensure that the tube is correctly positioned:-

(i) Insert the tube into its socket and ease into position in the Chassis Assembly. Do not fit the clamp or post-deflection accelerator lead (see Chapter I, Section 5 (d)).

(ii) Switch on the power supply to the Transmitter-Receiver Unit and allow two minutes for the Unit to stabilise.

(iii) Turn the function switch to RX B and the SEARCH/HOME switch to SLOW. Adjust the GAIN control to a suitable level and rotate the TRIG preset control on the Timebase Unit until the timebase runs freely. Reduce the gain to obtain a trace free from "grass".

(iv) Rotate the tube until the trace is aligned with the vertical

lines of the graticule.

(v) Fit the CRT clamp and connect the post-deflection accelerator lead. Verify that the trace is still vertical.

(vi) Reset the TRIG control as detailed in Section 4 (b) of this Chapter.

(b) Magnetic Correction

When a new CRT is to be fitted, magnetic centreing of the trace may be required. This can be determined by the method detailed below. If the magnet assembly of an existing CRT has been removed or disturbed during removal of the tube, the Ring Magnets will require repositioning and the same procedure applies to this operation as to the fitting of magnets to a new CRT.

(i) Raise the front end of the Chassis Assembly on a suitable support to a height of approximately four inches above the surface of the bench. Rest the detached Left-hand Side-panel, with plug PL301 connected, against the Chassis Assembly.

(ii) Insert the tube into its socket and support the front of the tube on the upper edge of the Left-hand Side-panel at a convenient angle for viewing.

(iii) Switch on the power supply to the Transmitter-Receiver Unit and allow two minutes for the Unit to stabilise.

(iv) Turn the function switch to RX B and the SEARCH/HOME switch to the HOME position.

(v) To determine whether a replacement tube requires magnetic correction, adjust the GAIN control to a suitable level and rotate the TRIG preset control on the Timebase Unit until the timebase runs freely. Reduct the gain to obtain a trace free from "grass" and inspect the trace. If any displacement of the trace from the centre of the screen can be detected visually under these

conditions, magnetic correction is required. Apply this correction as detailed in the following paragraphs.

(vi) Reset the TRIG control as detailed in Section 4 (b).

(vii) Connect the Signal Generator output to the port aerial plug, switch on the Signal Generator and Pulse Generator. Adjust the Signal Generator frequency to 243 Mc/s and the output level (modulated by 7μs pulses at 10 kc/s p. r. f.) so that no "grass" is visible on the trace.

(viii) Set the GAIN control to a convenient level and adjust the TUNE RX control for maximum signal amplitude, readjusting the GAIN control as required.

(ix) Coat the inner surface of the magnet Seating Ring with a suitable silicone compound, such as Releasil 7, to facilitate assembly and adjustment. Place the magnet assembly carefully over the front end of the tube, approximately 3/8 in. from the screen.

(x) Observing the display on the CRT screen, rotate the Seating Ring to a position where a central vertical trace, with undistorted horizontal pulses, is obtained.

(xi) If a satisfactory display cannot be obtained by rotation of the Seating Ring, rotate one of the Ring Magnets relative to the other. With some tubes, only one Ring Magnet may be required to obtain the best result.

(xii) The tube should be rejected if the trace cannot be centred by the amount of correction provided by the magnets.

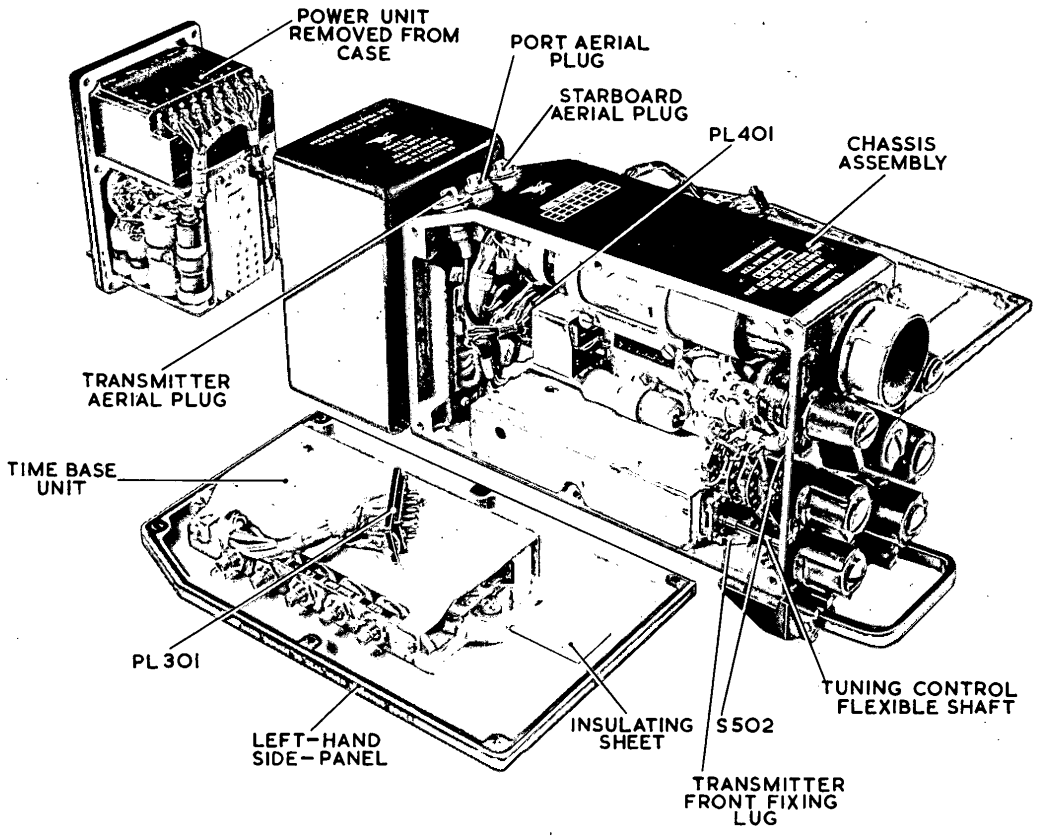
(xiii) When the magnet assembly has been correctly positioned, align and refit the CRT Assembly as detailed in (a) above and Chapter 2, Section 5(d). Take care not to disturb the magnet assembly during refitting.

Appendix 1

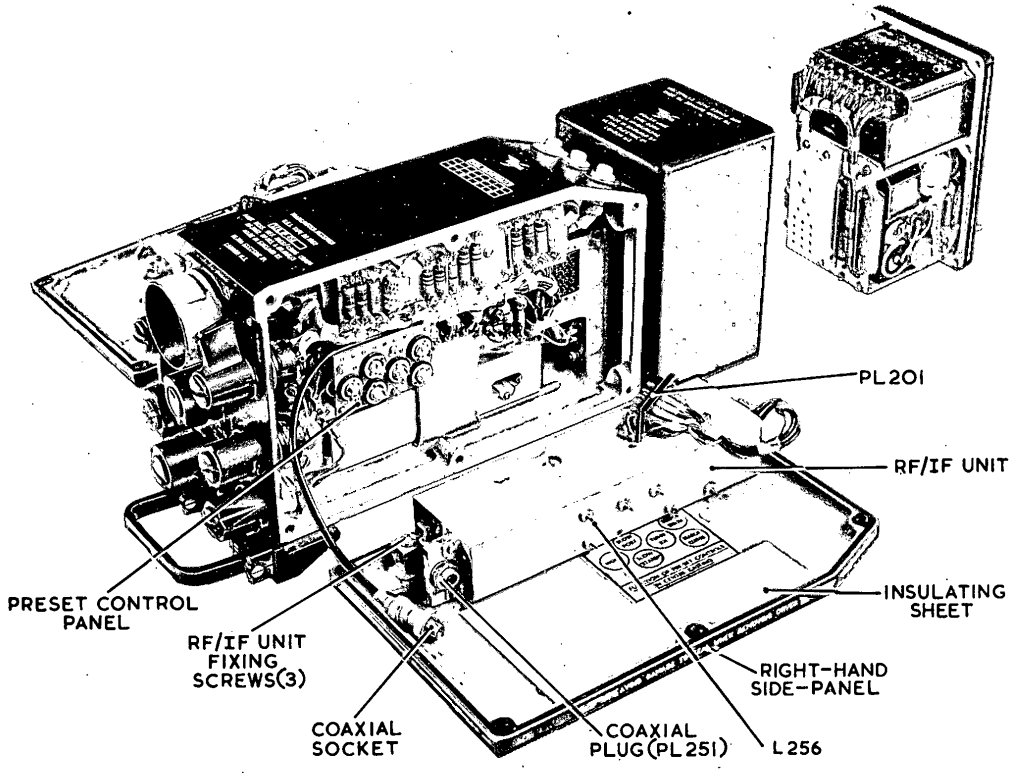
RECOMMENDED SPARE PARTS

DESCRIPTION	ULTRA TYPE	A. M. TYPE & REF.
Transmitter-Receiver Unit	R825	
consisting of:-		
Transmitter-Receiver	BR1082	Type 8971 Ref. 10D/20749
Power Unit	BP105	Type 8094 Ref. 10R/18240
Visor	BR1081-5	Type 300 Ref. 10AT/1557
The following sub-assemblies of Transmitter-Receiver Type BR1082:-		
Chassis Assembly	BR1082-1	
Transmitter Unit	BR1081-7	
Timebase Unit	BR1081-12	
RF/IF Unit	BR1082-30	
Cathode-ray Tube Assembly	X854-1000	
consisting of:-		
CRT	(G. E. C. Type) CAHA401	Type CV389
Ring Magnet(s)	B418-17	
Seating Ring	Y626-1023	

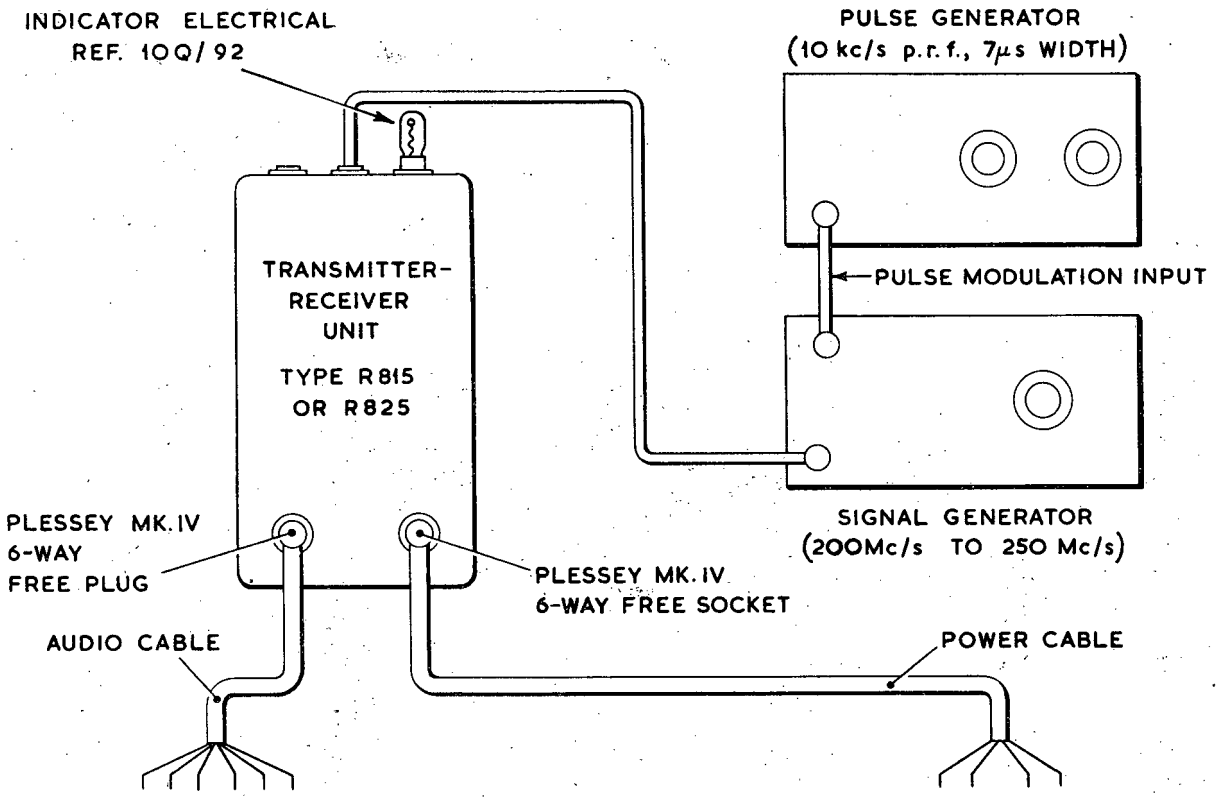
NOTE: Sub-assembly BR1082-10 (Search Unit), consisting of Oscillator Unit BR1082-31 and Switch Unit BR1082-32, is also available as a spare part. It is not recommended, however, that this item be renewed at second-line servicing level. Faults should be remedied by renewing the Chassis Assembly, of which the Search Unit forms an integral part.



H742 FIG. 1 TRANSMITTER-RECEIVER PARTLY DISMANTLED (LEFT-HAND SIDE)



H741 FIG.2 TRANSMITTER—RECEIVER PARTLY DISMANTLED (RIGHT-HAND SIDE)



LEAD CONNECTIONS

PIN REF.	COLOUR	CONNECT TO:
A	RED	TEL +
B	BLUE	TEL −
C	GREEN	MIC −
D	YELLOW	MIC +
**E	WHITE	PRESS TO TALK +
F	BLACK	PRESS TO TALK −

LEAD CONNECTIONS

PIN REF.	COLOUR	CONNECT TO:
A	RED	AC COMMON
*B	BLUE	80 V AC
*C	BLACK	115 V AC
D	BLANK	
E	GREEN	24 V DC − } AT
F	YELLOW	24 V DC + } 0·5A

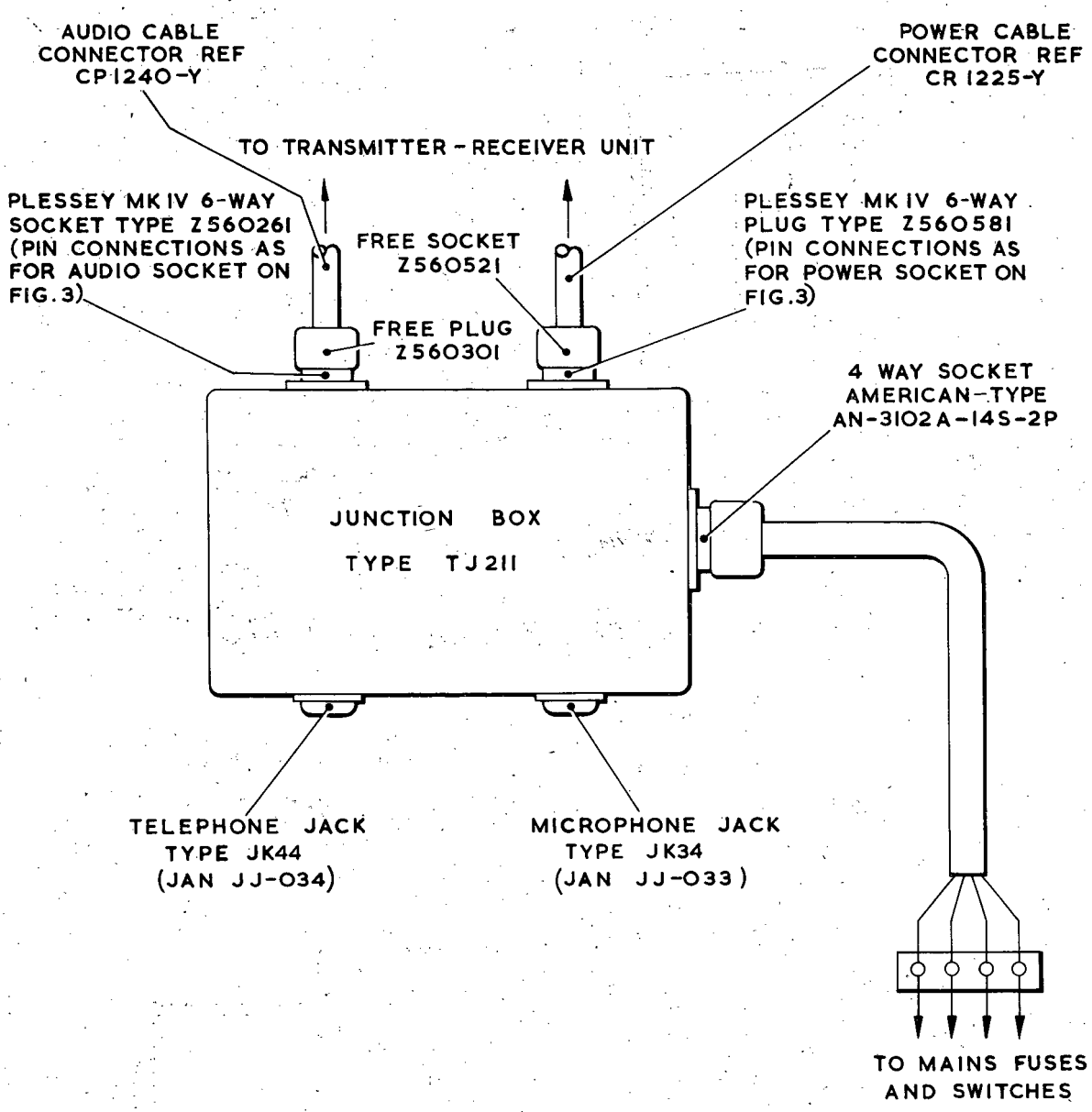
**IF PRESS TO TALK TYPE MICROPHONE IS USED, LEAVE FUNCTION SWITCH OF TRANSMITTER-RECEIVER AT RX R/T. OTHERWISE, OPERATE FUNCTION SWITCH BETWEEN TX R/T & RX R/T AS REQUIRED.

*EITHER 80V OR 115V AC, 400 c/s OR 800 TO 2,400 c/s, 75 VA, CAN BE USED.

NOTE :- SPEECH OUTPUT IS DESIGNED TO OPERATE TELEPHONES OF 100 TO 200Ω IMPEDANCE.
MICROPHONE INPUT IS DESIGNED FOR DYNAMIC MICROPHONES OF APPROXIMATELY 200Ω IMPEDANCE.

L770

FIG.3. TEST RIG CONNECTIONS FOR SECOND-LINE SERVICING



LEAD CONNECTIONS — POWER CABLE

PIN REF.	CONNECT TO
A	115V 400 c/s
B	22 TO 28V DC+
C	115V 400 c/s
D	22 TO 28V DC-

L775

FIG. 3A CONNECTIONS FOR JUNCTION BOX TYPE TJ 211
(APPLICABLE TO TRANSMITTER-RECEIVER UNIT TYPE R825 IN AMERICAN-TYPE INSTALLATIONS)

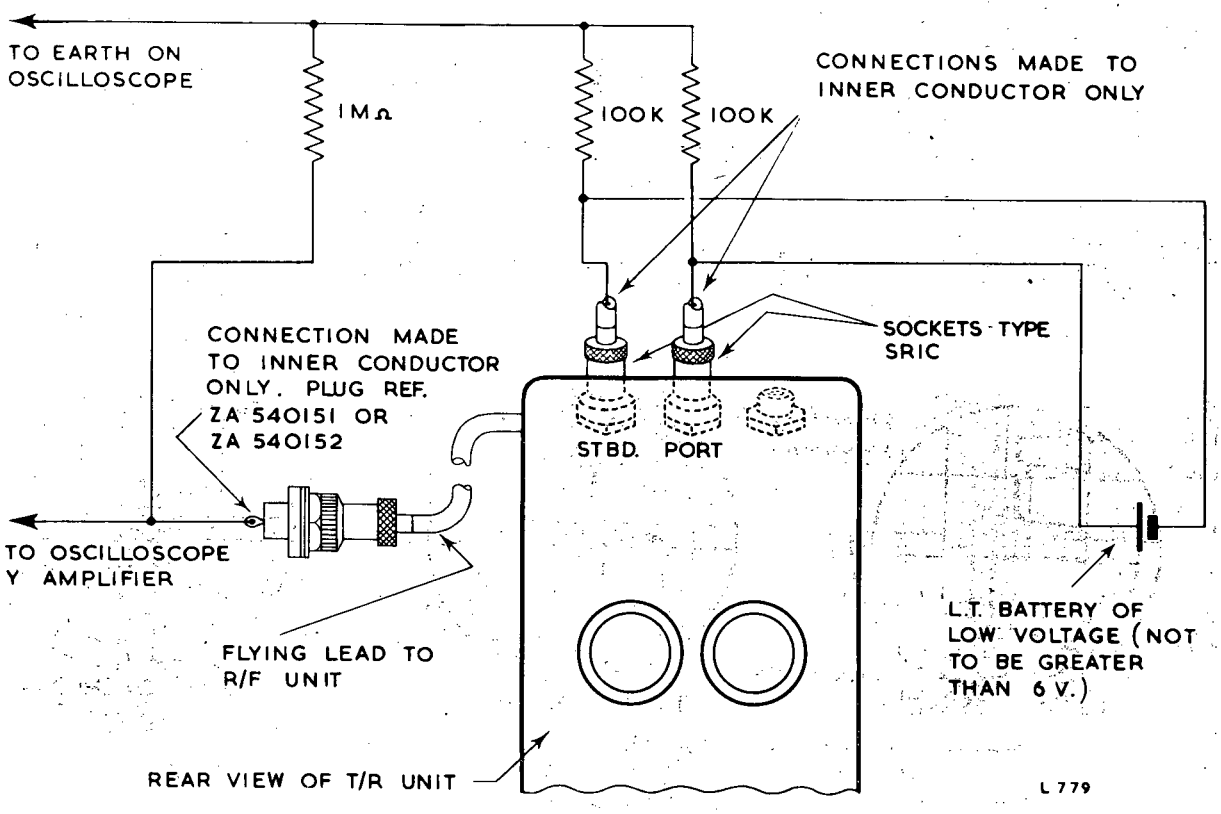


FIG. 4. TEST CIRCUIT FOR AERIAL SWITCH

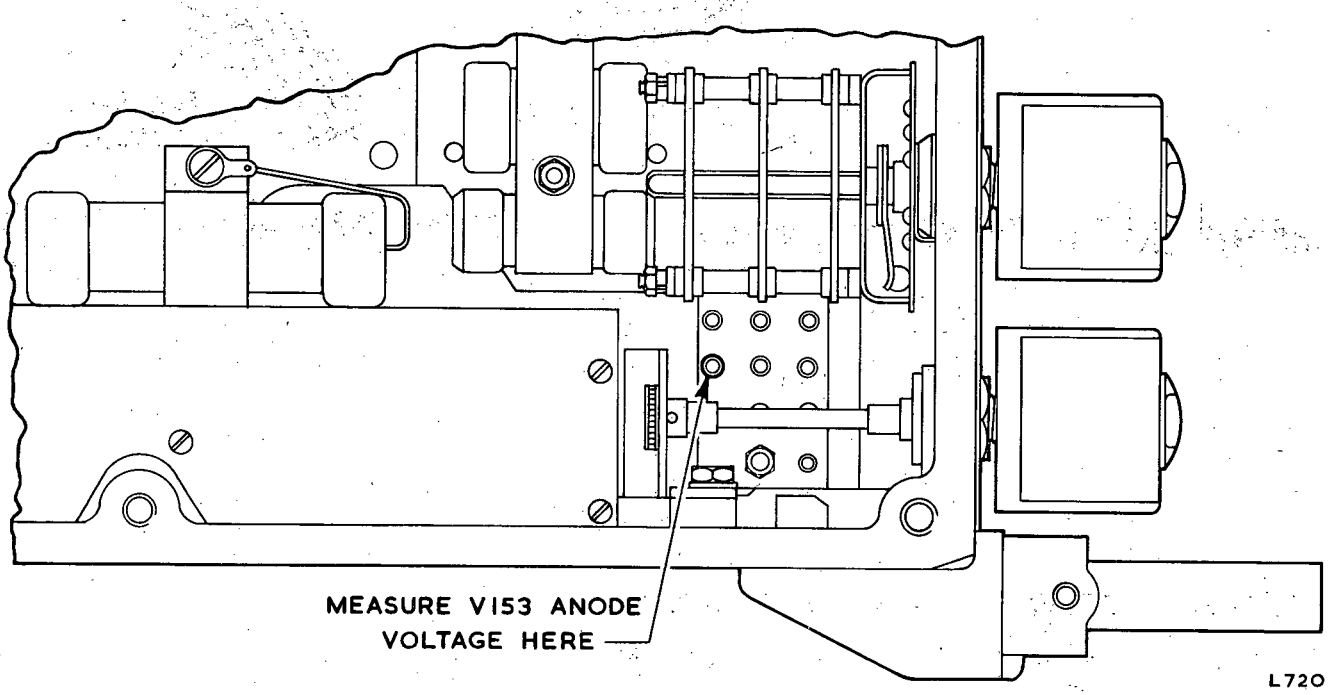


FIG. 5. TEST POINT — OSCILLATOR TUNING CIRCUIT

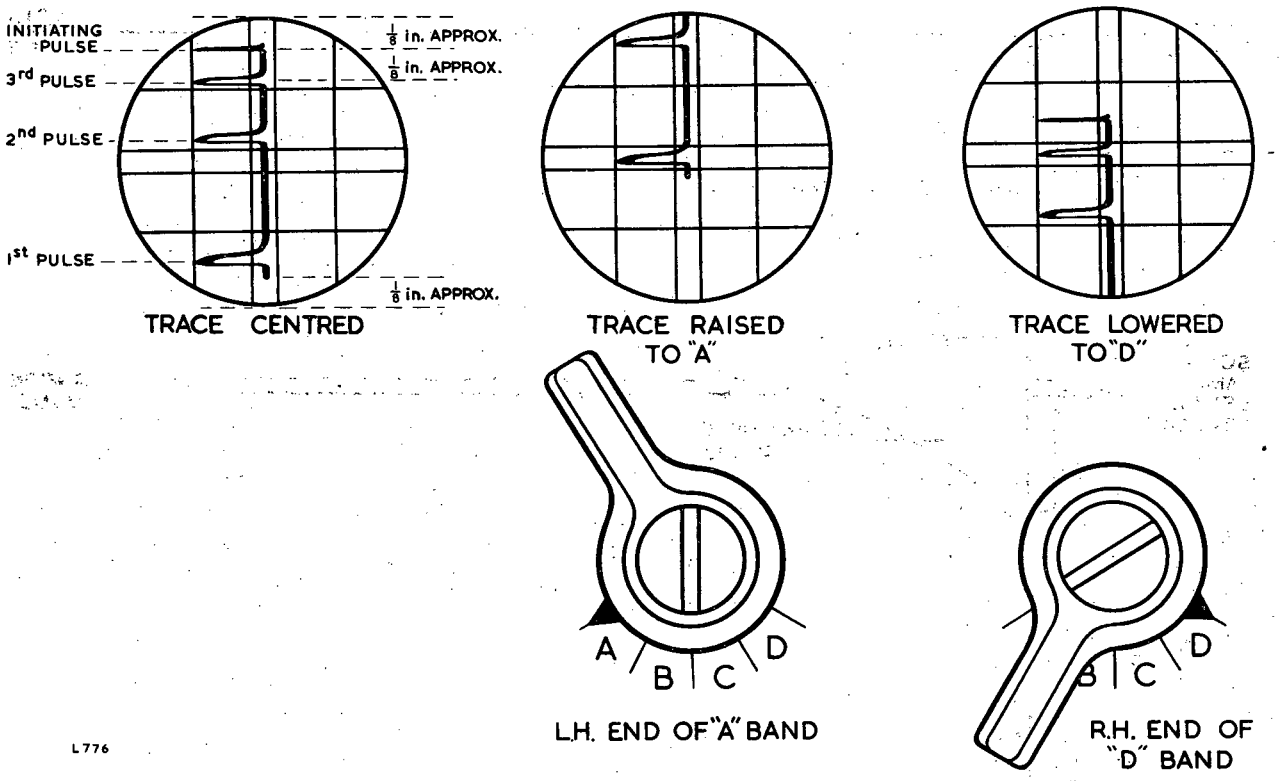


FIG. 6. CRT DISPLAY — TIMEBASE CORRECTLY ADJUSTED

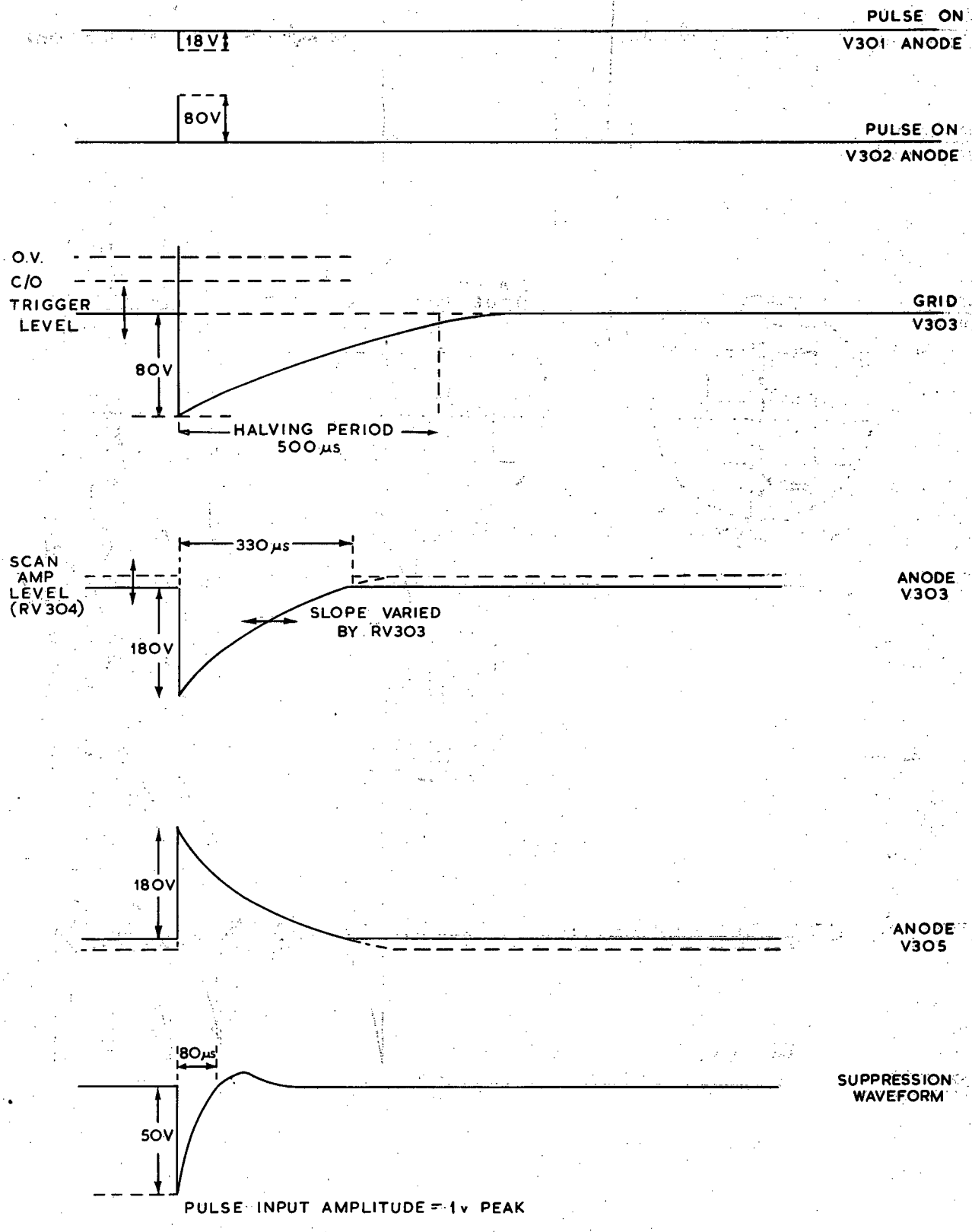


FIG.7. TIMEBASE UNIT WAVEFORMS — BEACON

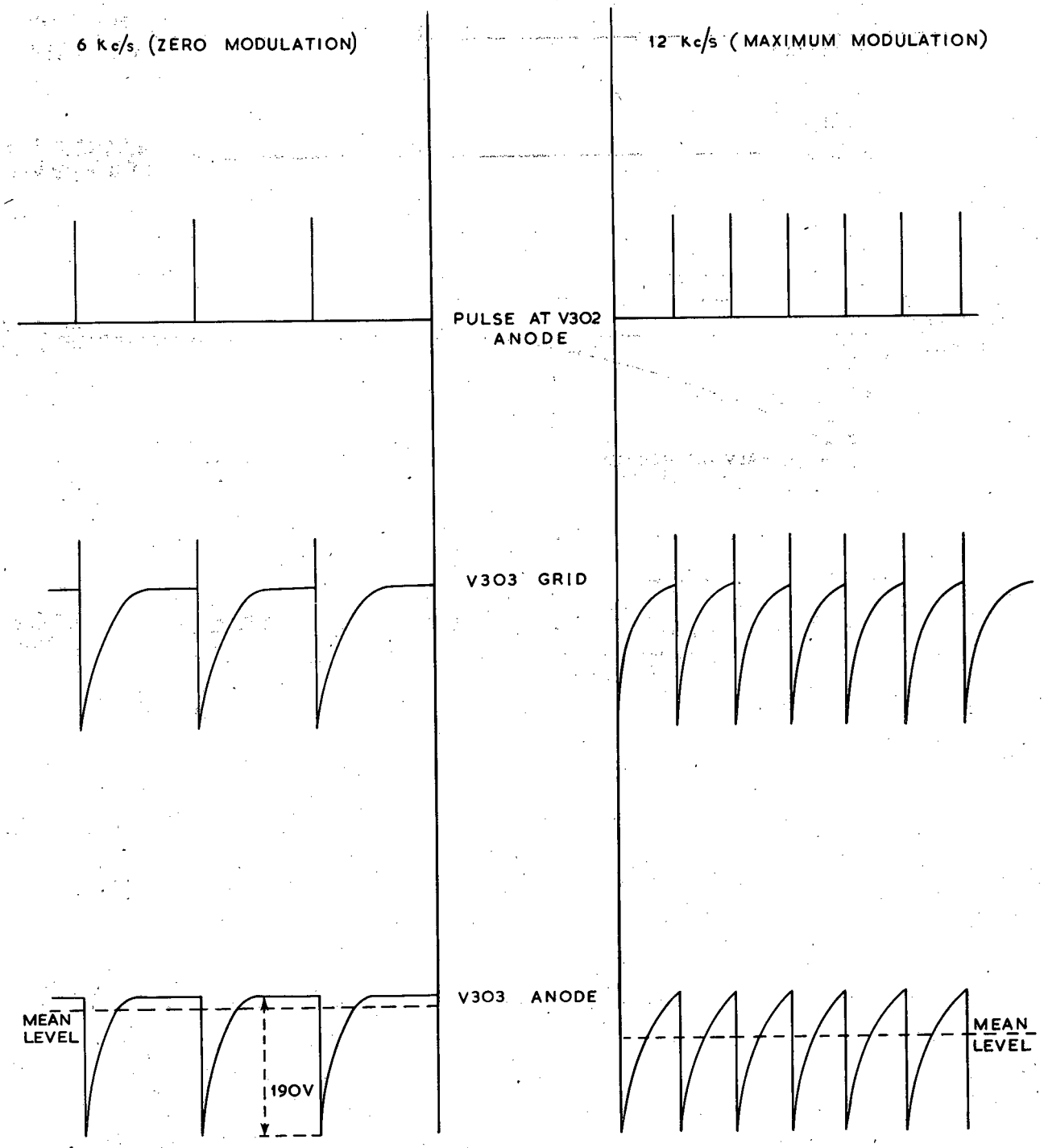


FIG. 8. TIMEBASE UNIT WAVEFORMS – SPEECH

Issued by Technical Publications Department
Messrs. ULTRA ELECTRIC LIMITED, LONDON, W.3

PUBLICATION No. PM 1011

DATE SEPTEMBER 1956

COPY No.

SECRET

SARAH

SEARCH EQUIPMENT

PROVISIONAL

OPERATING INSTRUCTIONS

(TRANSMITTER-RECEIVER TYPE BR1082)

ULTRA ELECTRIC LIMITED

LONDON, W.3 ENGLAND

SARAH TRANSMITTER-RECEIVER TYPE BR1082

PROVISIONAL OPERATING INSTRUCTIONS

Contents

Illustrations

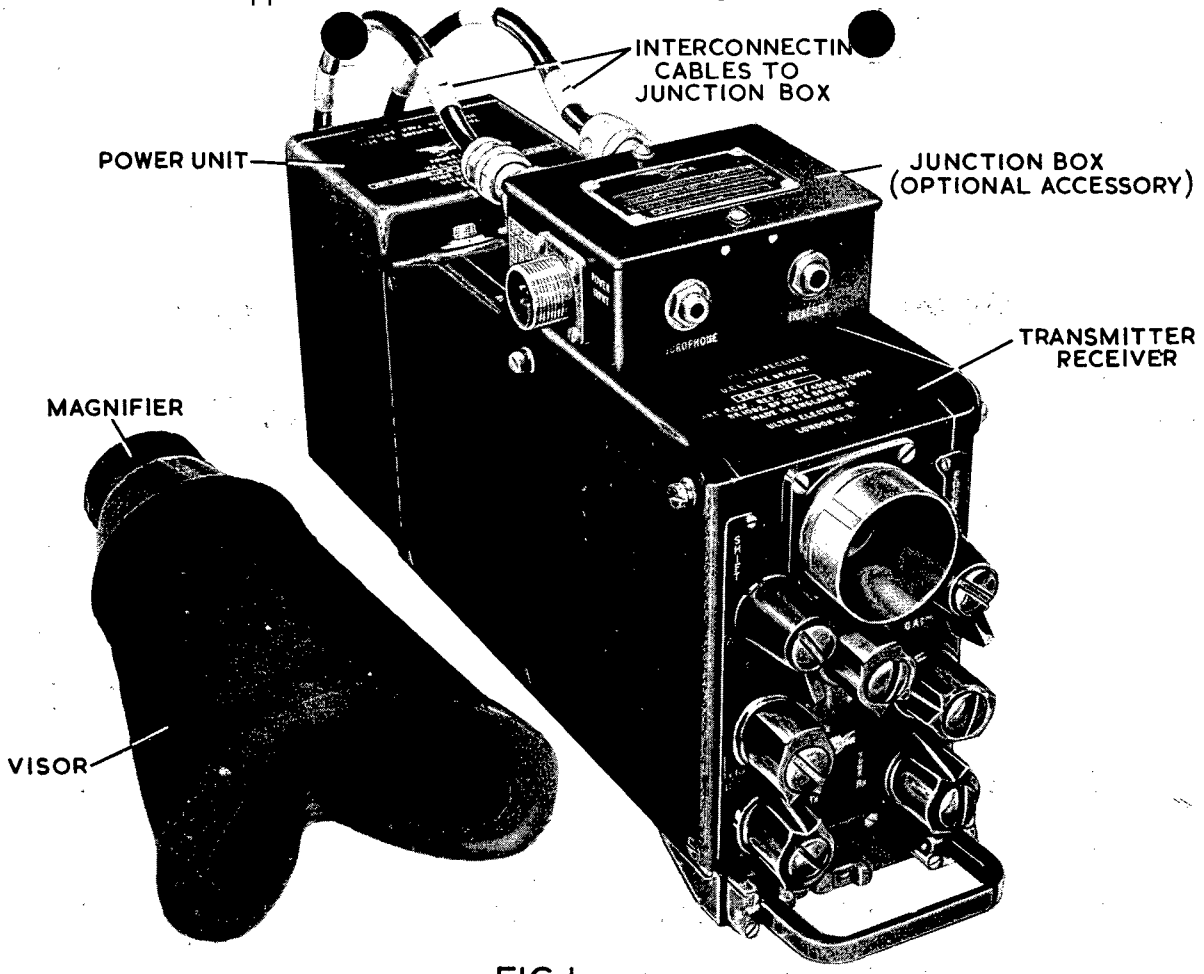


FIG.1

TRANSMITTER–RECEIVER UNIT AND VISOR

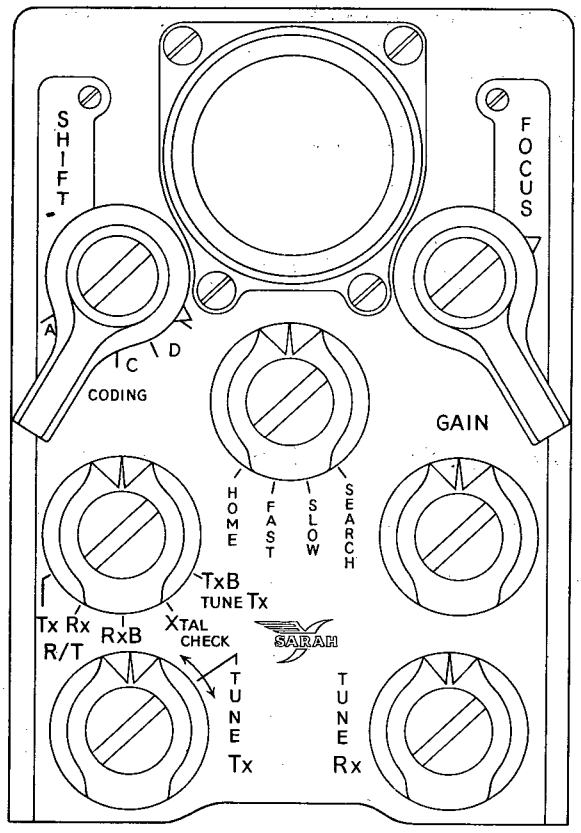
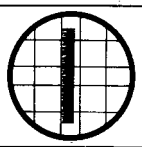
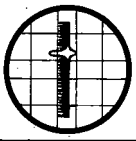
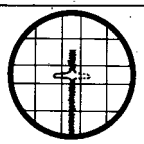
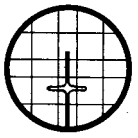
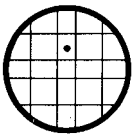
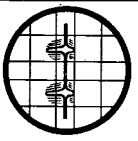
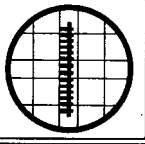
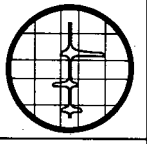
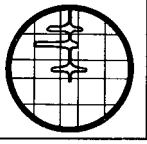
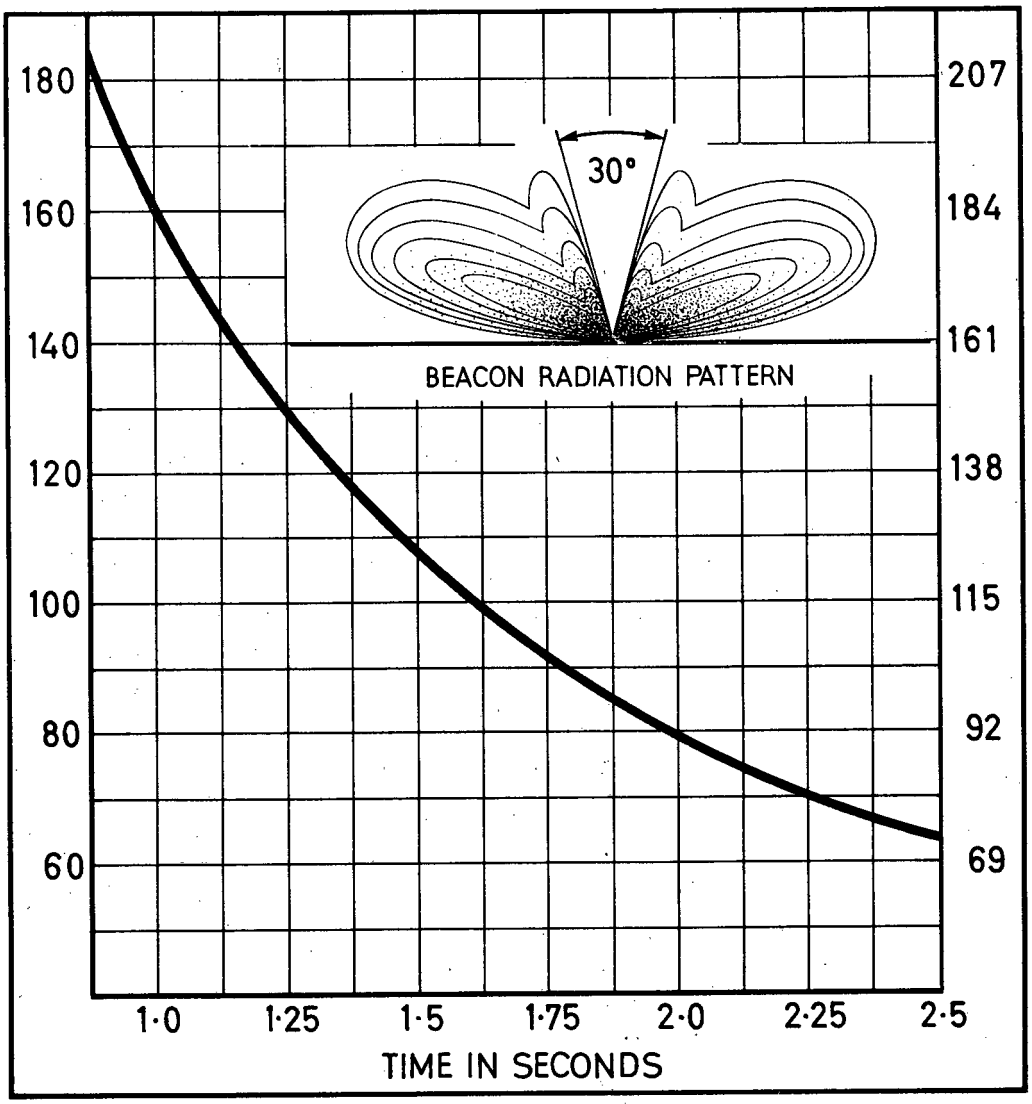


FIG.2 FRONT PANEL CONTROLS

CONDITION	TYPICAL ALTITUDE	RECEIVER PICTURE	REMARKS
Search phase before reception of Beacon signal.	Aircraft 10,000 feet Helicopter 3,000 feet Surface vessel aerial height 25 ft.		Centre switch on SEARCH. GAIN set for appearance of green trace, and increase until "grass" just reaches inner graticule lines. Left-hand (function) switch to RX.B.
Search phase on reception of Beacon signal. Beacon on port side.	Aircraft 10,000 feet Helicopter 3,000 feet Surface vessel aerial height 25 ft.		Centre switch to SLOW TUNE RX control tuned manually for maximum signal. Centre switch to FAST.
Beginning of homing phase.	Aircraft 5,000 feet Helicopter 1,500 feet Surface vessel aerial height 25 ft.		SHIFT adjusted to bring beacon pulse between horizontal graticule lines. Turn towards larger signal to equalize.
Transmitter tuning.			During early homing set function switch to TUNE TX. Tune transmitter to receiver for maximum signal, adjusting GAIN as necessary. Return function switch to RX.B
Late homing phase.	800 feet		GAIN control adjusted during homing to keep signal between outer graticule lines. Centre switch to HOME for accurate homing display.
Aircraft goes through null and obtains fix.	500 feet		Beacon signal increases rapidly and suddenly vanishes as aircraft passes overhead.
Beacon signal reappears after null.	500 feet		Aircraft orbits to port around survivor ready for speech reception. Thus, Beacon signal on port side.
Speech from Beacon (received on port aerial).	500 feet		P.R.F. of Beacon modulated by voice. Function switch at RX.B To listen, turn switch to RX.R/T.
Beacon on LISTEN. (Signal received on port aerial).	500 feet		Function switch at RX.B. Searcher clearly knows that he can talk and be heard. Turn left hand switch to TX.R/T. (or press P. to T. switch) and talk.
NOTE: If the craft cannot rescue survivors the receiver may be switched to TX.B. Other rescue craft can then home on the longer-ranged signal. Aircraft should climb to a higher altitude to increase range of transmission.			
Three Beacons: 1 on port, 2 on starboard.	C B A		Pulse spacing characterizes 3 different Beacons.
Three Beacons: 2 on port. Aircraft homing on Beacon 'A.'	C B A		Homing may be done on one Beacon at a time — approx. range indication (relative amplitude of pulse) shows which one to "fix" first.

L750

FIG. 3.—GUIDE TO OPERATION—TRANSMITTER-RECEIVER TYPE BR1082



SPEED OF SEARCH AIRCRAFT PLOTTED AGAINST TIME FOR PASSAGE OF NULL ZONE OVER BEACON AT 500ft.

Speed in knots at L.H. side; in M.P.H. at R.H. side.

Inset shows Beacon Radiation Pattern

TL150.

FIG. 4. RADIATION DATA

OPERATIONAL PROCEDURE DURING AN AIRBORNE SEARCH

Fig. 3 (Guide to Operation) shows the sequence of events during an airborne search and Fig. 4 the characteristics of the beacon radiation around the null point. The search operator should be well exercised on these diagrams before undertaking a search.

1. PREPARATION FOR USE

(a) Place the main distribution switch at SARAH and switch on the relevant power supplies.

(b) Allow approximately two minutes for the Transmitter-Receiver to stabilise.

(c) Turn the left-hand (function) switch (Fig. 2) to the RX B position.

(d) Turn the GAIN control clockwise until a green trace appears on the CRT screen. Adjust the SHIFT control to bring the whole of the trace on to the screen.

(e) Adjust the FOCUS control to obtain a bright and sharp trace.

(f) Adjust the GAIN control so that "grass" just appears on the trace, but do not allow the grass to swamp the screen.

(g) Turn the SEARCH/HOME switch to SLOW. The port and starboard aerials are now being selected at a rate of six cycles per minute, i.e., each is connected in turn to the receiver for 5 seconds, followed by a rapid changeover to the other.

(h) Turn the function switch to the XTAL CHECK position. A series of crystal-controlled pulses should now appear on each side of the trace, indicating that the Transmitter-Receiver is functioning on the correct frequency. Adjust TUNE RX control for maximum and reduce GAIN control as necessary.

(j) Turn the function switch to the SEARCH position and ensure that the automatic frequency sweep is operating. This is visible as a regularly-recurring change in the pulse amplitude, as

displayed on the screen, twelve times per minute. The frequency sweep ensures that a beacon is not missed because of some small discrepancy in its nominal frequency.

(k) Return the function switch to the RX B position. The Transmitter-Receiver is now correctly adjusted.

(m) Carry out the Long-range Search procedure detailed below.

2. LONG-RANGE SEARCH

A search should initially be made at the highest possible altitude, to ensure maximum range of reception. At an altitude of 10,000 ft, for example, the beacon signal can be detected at a range of more than 70 statute miles, over sea.

The aerials have been positioned specifically to provide maximum search coverage on each beam, with an adequate forward-looking range for homing purposes. Thus, standard search patterns such as "Creeping Line Ahead" can be followed with advantage.

Throughout the search, carefully observe the trace on the CRT screen as the port and starboard aerials are alternately selected. A beacon signal, when first detected, will appear only momentarily as the receiver tunes through it and confirmatory action should immediately be taken as described in the following section.

3. CONFIRMATORY ACTION

Assuming that a "Creeping Line Ahead" search is being carried out, and that the beacon signal appears on the port side, the aircraft should maintain its present heading. When the signal reappears (after 10 seconds) its amplitude will be greater as the point of maximum search aerial sensitivity is approached. This may give a sufficiently positive identification of the signal to enable Homing to proceed (see Section 4).

If there is difficulty in identifying the signal, the aircraft should turn through 180^{o} (in this case, to port) and arrive on a course about five miles inwards towards the suspected position of the beacon. Watch for the momentary

reappearance of the signal (in this case, on the starboard side). Should there be no positive identification of a beacon signal, resume the original course and continue the search.

When a beacon signal has been identified, turn the SEARCH/HOME switch to the SLOW position and adjust the TUNE RX control for maximum signal amplitude.

NOTE: If the beacon signal appears on both port and starboard sides, the aircraft should be directed towards the larger signal until the signal pulses are equal on both sides of the CRT trace. The procedure given in Section 4, paragraphs (a), (b), (c), (g), (h), and (j) below can then be followed.

4. INITIAL HOMING PHASE

The operating procedure during this part of the search is given below:-

(a) Turn the SEARCH/HOME switch to FAST. The port and starboard aerials are now being selected at a rate of 30 cycles per minute, i. e., each is connected in turn to the receiver for one second, followed by a rapid changeover to the other.

(b) Check that the receiver is tuned exactly to the beacon signal.

(c) If more than one beacon signal is observed, rotate the SHIFT control to centre the selected signal between the horizontal graticule lines.

(d) At this stage the signal may appear only on the port or starboard side of the vertical trace. The aircraft should therefore turn through 90^{o} - to port if the signal is on the port side or to starboard if the signal is on the starboard side - while the trace is carefully watched.

(e) During this manoeuvre, the signal will gradually fall on the side at which it was first seen and begin to rise on the other side as the aircraft turns towards the direction of the beacon. When the signals appear equal on both sides, the aircraft heading should be steadied and this course maintained.

(f) Alternatively, at extreme range, the signal may disappear as the aircraft approaches the 90^{o} bearing. If the signal is lost, the aircraft should fly a weaving course 45^{o} to either side of the new line of flight as a confirmatory check on the presence of the signal.

(g) When a useful signal amplitude has been obtained on the CRT screen, direct the aircraft on to the correct course as indicated by the relative signal amplitudes alternately displayed to port and starboard of the trace.

(h) If the amplitude is greater on one side than the other, the aircraft should fly in the direction of the larger signal, in steps of 10^{o} from the original line of flight, until the displayed pulses are equal on both sides.

(j) Carry out the close-range homing operation detailed in the following section.

5. SECOND HOMING PHASE

(a) Turn the SEARCH/ HOME switch to HOME. The port and starboard aerials are now being selected at a rate of 600 cycles per minute and, because of the long persistence of the CRT screen, the signal will now appear on both sides of the trace simultaneously.

(b) Throughout the homing phase, an equal signal amplitude should be maintained on each side of the trace.

(c) Adjust the GAIN control as required, so that the signal amplitude just reaches the outer vertical lines of the graticule.

(d) During the homing phase, the aircraft should gradually reduce altitude to the final approach height of approximately 500 ft.

CAUTION: If the aircraft reduces altitude too quickly, the beacon signal may be lost.

(e) When a signal of sufficient amplitude has been obtained, tune the transmitter as follows:-

(1) Check that the receiver is correctly tuned, as described in section 3 above.

(2) Turn the function switch to the TX B/ TUNE TX position.

(3) Adjust the TUNE TX control so that the amplitude of the displayed signal is a maximum, reducing the gain as necessary.

(4) Return the function switch to the RX B position.

(f) The transmitter is now tuned to the beacon ready for speech transmission.

6. FINAL APPROACH AND SPEECH COMMUNICATION

(a) Continue the homing procedure, always maintaining a display of equal amplitude on each side of the trace and readjusting the GAIN control as required.

(b) As the final approach is made to the beacon, the signal display will rapidly increase to a maximum amplitude and then as rapidly decrease to zero (see Fig. 4 for Beacon Radiation Pattern).

The beacon is now immediately below the aircraft.

At this point the aircraft's position should be fixed, using Gee, visual means or any available navigational aid, and transmitted to the appropriate rescue authority.

(c) The signal will reappear as the aircraft continues on course.

When this occurs, the aircraft should turn to port and orbit around the position where the zero signal was obtained.

NOTE: In the RX R/T position of the function switch, aerial switching ceases and the port aerial is continuously connected to the receiver for speech reception. A port orbit places this aerial nearer to the beacon.

(d) At this stage, the survivor may decide to use the Speech Unit of his beacon to make R/T contact with the aircraft. When speech transmission begins, the single pulse displayed during normal beacon transmission will change to two or three pulses, which will "jitter" about their relative positions on the trace in accordance with the speech modulation.

(e) Immediately these characteristic signals are seen, turn the SARAH/NORMAL INTER-COM. switch in the aircraft to SARAH and the Transmitter-Receiver function switch to RX R/T, to receive the survivor's message.

NOTE: If Junction Box Type TJ211 is fitted, insert the microphone and telephone plugs into the jacks on the front of the Junction Box, then turn the function switch to RX R/T.

(f) To reply when the survivor's message ends, turn the function switch to TX R/T and speak into the headset microphone.

Alternatively, if the press-to-talk facility is incorporated in the SARAH installation, leave the function switch at RX R/T and operate the press-to-talk switch on the microphone before replying.

NOTE: When the survivor has pressed his LISTEN button for speech reception, the CRT display will consist of several small signal pulses equally spaced down the trace. This can be verified by turning the function switch to the RX B position and observing the display.

7. STANDBY OPERATION

The search aircraft may not be equipped to rescue a survivor. In this event, the aircraft may stand by until a suitably-fitted aircraft or surface vessel arrives.

To assist in directing a rescue craft to the survivor, turn the function switch to TX B/TUNE TX. The Transmitter Receiver is now transmitting a pulse signal of similar type to that emitted by the beacon, with the advantage of greater range conferred by the height of the aircraft. A rescue craft, even if based a considerable distance from the survivor's position, will thus be able to use its SARAH equipment to pinpoint this position.

For example, a launch can receive signals over a range exceeding 40 miles from an aircraft circling at 5,000 ft., and will home on these signals until it approaches within 6 to 7 miles of the survivor. At this point the launch will begin to pick up signals from the survivor's own beacon transmitter and will thenceforward home directly on to him.

IMPORTANT NOTE: **When the survivor has been rescued, switch off his beacon at the earliest opportunity to prevent further radiation of the pulse signal.**

APPENDIX 1

MARINE INSTALLATIONS

The foregoing operational procedure also applies, in general, to the Transmitter-Receiver Unit as fitted to marine craft, provided that the references to altitude and overhead null are disregarded.

During homing, the amplitude of the beacon signal displayed on the CRT screen should be maintained equal on both sides of the vertical trace. The ship is thus directed towards the beacon until the survivor is actually seen (refer to Fig. 3, "Guide to Operation").

Where the DF Homing Aerial is fitted, and in conditions requiring its use (e. g., fog, darkness or rough sea), the survivor's position is found by rotating the Aerial to the null signal position (in which the plane of the Aerial is at right-angles to the survivor's bearing) and reading off the bearing on the Indicator Unit at the operator's position.

NOTE: Full information on Marine Installations will be included in another publication at a later date.

Issued by Technical Publications Department
Messrs. ULTRA ELECTRIC LIMITED, LONDON, W.3